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INFORMATION ON INTERNATIONAL GEOPHYSICAL COOPERATION -- SOVIET-BLOC ACTIVITIES

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I. ROCKETS AND ARTIFICIAL EARTH SATELLITES

"Sovetskaya Aviatsiya" Article on the Successful Return to Earth of the Second Soviet Spaceship

At 1030 hours Moscow time the spaceship completed its 16th revolution around the Earth as it continued its travels in its prescribed orbit. Newly received telemetric data confirms that all apparatus aboard the spaceship is functioning normally.

The conditions required for the life activities of the animals aboard is being constantly maintained in the spaceship cabin.

The condition of the animals is satisfactory. In the tenth hour of flight the dog "Strelka" showed a pulse of 106 and respiration of 30 per minute; "Belka" had a pulse count of 120 and breathing was at the rate of 40 per minute.

Television observations are being systematically made of the condition of the animals; this is also being recorded on movie film. The resulting motion picture stills show that from time to time there is a heightening of movement on the part of the animals.

According to the latest data, the period of revolution of the satellite around the Earth is 90.72 minutes. The minimum height of the orbit above the Earth's surface is 306 km, while the maximum height is 339 km. The decrease in the period of revolution as a result of air resistance is 0.003 minutes per day. The refined value for inclination of the orbital plane to the equator is $64^{o}57.3'$.

All facilities engaged in terrestrial measurements are operating normally. A great amount of measured data has been received; this is being fed to electronic computers for continual refinement of the parameters of the satellite's orbit.

* * * *

After completion of the program of investigations, planned for one day, and the recording of data on the life activity of the animals and the normal functioning of the apparatus aboard, the spaceship was given a command for it to descend from its orbit. The command was transmitted when it was making its 18th revolution. The spaceship's control system and braking apparatus operated with great precision; this facilitated the descent of the ship in the prescribed area. The deviation between the actual point of landing and the computed point was about 10 kilometers.

The spaceship weighed 4,600 kg (not counting the weight of the last stage of the rocket-carrier); it carried special heat insulation and was able to pass through the Earth's atmosphere successfully. The spaceship and the separable capsule containing the experimental animals reached the Earth's surface in good condition.

Planes and helicopters delivered medical and technical personnel to the point of landing.

All of the experimental animals, including the dogs "Strelka" and "Belka" are in good condition following the flight and landing.

A thorough examination of the animals which have returned from cosmic space is currently in progress. The apparatus worked out had ensured the normal life activity of the animals while in flight.

Thus, for the first time in history, living creatures safely returned to Earth after completion of a flight in space of more than 700,000 km.

The launching and return to Earth of this spaceship, created by the genius of Soviet scientists, engineers, technicians and workers, is a precursor of a flight by man into interplanetary space. ("For the First Time in History Living Creatures are Safely Returned from Space to Earth," Sovetskaya Aviatsiya, 21 August 1960, p 1)

Soviet Account of the Passengers Aboard the Second Soviet Spaceship

On 21 August 1960 the first animals to return from a flight into outer space arrived in Moscow.

As already reported, the dogs Belka and Strelka were among the passengers on the second Soviet spaceship. In addition, there were other animal passengers who were sent to facilitate study of the influence of radiation and conditions of flight in space -- 40 mice, 2 rats, insects, grains of cereals, and a number of microbes.

The spaceship cabin housed 13 white laboratory mice and 15 gray mice and 2 white rats.

The catapulted container held Belka and Strelka, 6 white and 6 gray mice and the following insects: Drosophila -- in 15 flasks; plants -- spiderworts in two flasks; Chlorella in 8 ampules in a liquid nutritive medium in suspension form and in 4 ampules in slant agar; fungal cultures -- Actinomyces in 14 ampules; seeds -- corn and different varieties of wheat, peas, onions and Nigella.

The spaceship cabin also contained small segments of skin (human and rabbit) in 2 ampules; HeLa cancer cells in 6 ampules; and microbes -- KK-12 intestinal bacilli in 11 ampules, B intestinal bacilli in 6 ampules, intestinal bacilli of the aerogenes type in 4 ampules; butyric acid fermentation bacteria in 2 ampules; staphylococci in 2 ampules; deoxynucleic acid in 6 ampules; T-2 bacteriophage in 3 ampules and 13-21 bacteriophage in 3 ampules.

The following apparatus was carried aboard the spaceship for scientific research:

--for investigation of light and heavy nuclei in primary cosmic radiation;

--for investigation of the X-ray and ultraviolet radiation of the Sun;

--for recording the levels (dosage) of cosmic radiation in the container housing the animals.

Aboard the ship there were blocks of thick-layered nuclear photoemulsions with a total weight of about 60 kilograms; in one of the photoemulsion blocks there was provision for the developing of photoemulsions directly aboard the ship.

The scientific information is stored and on command is transmitted to the Earth. In this case the transmission of the stored information to the Earth was accomplished after each revolution of the ship around the Earth, and also before landing.

In addition, in the process of landing, the autonomous recording system on board continually recorded changes in the physiological data for the experimental animals.

The blocks containing the nuclear photoemulsions and all the apparatus for scientific investigations were returned to Earth on board the ship.

The television system aboard the ship provided a great deal of valuable information and this has been recorded in movies. The recording of the images was synchronized very accurately with the recording of telemetric data; this has made it possible to compare the direct observations of the animals with the objective data on changes in their physiological functions, transmitted to Earth by means of the telemetric system.

Additional computations of the orbital elements of the second Soviet spaceship have confirmed that at all times its movement has been in an orbit extremely close to that originally computed.

A precise calculation of the various factors influencing the motion and descent of the spaceship, the continuous processing of the results of measurements of its orbital elements on electronic computers, and a computation of their changes, as already reported, made it possible to bring about the landing of the ship with a high degree of accuracy.

The special radio transmitters installed in the ship and in the container sent out radio signals during the descent and after the landing of the spaceship and the catapulted container. This made it possible to constantly "zero-in" the position of the ship and container and track them right up to the point of landing.

All the animals and biological specimens are in good condition.

The program of scientific research and measurements has been completed. The resulting data are now being processed and thoroughly studied. ("Program of Scientific Research Successfully Accomplished -- Details on the Spaceship 'Passengers'," Ekonomicheskaya Gazeta, 23 August 1960, p 1)

Cross Section of Current Soviet Press Articles on the Second Soviet Spaceship

Academician A. Berg, writing in an article entitled "We Have Come Closer to the Goal" (Ekonomicheskaya Gazeta, 20 August 1960, p 1) writes briefly and in general terms, but like many other scientists and journalists writing on this subject he "beats the drums," preparing the Soviet people for the imminent putting of a man into space, although without ever actually being very definite as to when this event may be expected.

A. Masevich, Deputy Chairman of the Astronomical Council of the Soviet Academy of Sciences, after reviewing the successes of the second Soviet spaceship, reports that there are 92 stations in the USSR and 300 abroad which are making visual and photographic observations of the ship. His article, entitled "New Victory," appears on the same page of the "Ekonomicheskaya Gazeta" as the Berg article mentioned above.

Major General G. I. Pokrovskiy, in an article on page 2 of the August 21, 1960 edition of "Sovetskaya Aviatsiya" entitled "Before Man's Take Off to the Stars," writes that the principal obstacles to human flight in space have now been overcome. The time is propitious for travel in space, he adds, because the period of maximum solar activity has passed and space travel has become safer.

A. A. Pistol'kors, Corresponding Member of the Academy of Sciences, in a TASS article entitled "Complex Radiotechnical Apparatus Worked Faultlessly" on page 1 of the "Ekonomicheskaya Gazeta" of 24 August 1960 reviews the information on the electronic equipment aboard the spaceship and on earth, used for both control and communication. He has nothing new to add to already available information, his article being a mere rehash of previously published data.

V. Strayzhis, Chief of the Vil'nyus Artificial Satellite Observation Station, in an article appearing alongside the Pistol'kors article, offers congratulations to the Soviet engineers and scientists responsible for the latest Soviet space triumph. His brief article, entitled "Signal Light Detected in Space," is typical of informal articles that are published in the Soviet press whenever outstanding events occur.

Page 1 of the "Ekonomicheskaya Gazeta" of 25 August 1960 carries a report on the press conference held at the Academy of Sciences of the USSR on 24 August, subsequent to the return of the spaceship passengers to Earth. The report of the press conference is carried under the banner "Outstanding Achievement of Soviet Science and Technology." This press conference, covered by correspondents of all nations, has been fully reported in the American press.

II. UPPER ATMOSPHERE

"Comparisons of the Parameters of Radio Reflection with Variations of the Magnetic Field During Auroras" -- A Full Translation of an Academy of Sciences Report

This report is based on the results of radar observations (on the 4 m band) made at the station "Roshchino" ($\varphi = 60^\circ.2$; $\lambda = 29^\circ.6$), and magnetic measurements made at Voyeykov ($\varphi = 59^\circ.9$; $\lambda = 30^\circ.7$), most of them during the course of the International Geophysical Year. Measurements were made of distances and azimuths of regions of ionization arising at the time of magnetic storms and auroras.

The maximum distance recorded by the apparatus was 1,200 km. Measurements were made each 15 minutes on the days of special and regular observations provided for by the IGY program. The radar apparatus was equipped with a rotating antenna system having two principal lobes whose directions coincided in the azimuthal plane. The tilt angles corresponding to the lobe maxima were 10° and 30°, the half-width of the lobes (at half power) was 20° in the azimuthal plane and 10° in the vertical plane.

We have made an attempt to quantitatively compare the parameters of radio reflections with variations of the horizontal component of the Earth's magnetic field (H). Variations in the vertical component (Z) were not taken into account because they are less important for the results of the observations made.

Statistical Distribution of Reflections on the Distance -- Azimuth Plane

An investigation of the statistical characteristics of the radio reflections shows that the positioning of the reflecting regions is due primarily to the character of the magnetic field for some distance from the station of observation [1, 2]. In the case of "Roshchino" the regions of reflection are concentrated in a zone having the form of a curved zone, almost symmetrical to the azimuth $+5^\circ$ (the zero azimuth is ascribed a direction of geographical north). The indicated azimuth is close to the angle of declination of the magnetic field at the Earth's surface ($\sim 6^\circ$) and differs greatly from the angle of declination of the dipole component of the field ($\sim -21^\circ$). If we assume that the field at a height of 100 km is approximately similar to the field at the Earth's surface, the coordinates of the zone of the most frequent reflections may be computed, proceeding from the following requirements: a) the perpendicularity of the vector of intensity of the magnetic field (assumed to be invariable for heights from 0 to 200 km) to the vector connecting the points of observation and reflection; b) the constancy of heights of reflecting regions.

The first of these requirements expresses the condition of the maximum value of the signal reflected in the reverse direction if we assume that the reflections are produced by a large number of relatively small regions of high ionization situated along the direction of the magnetic field. This assumption is easily explained on a physical basis since the paths of the charged particles in the Earth's magnetic field causing the observed ionization will possess similar properties. A detailed analysis of the possibility of receiving signals reflected perpendicular to the direction of the magnetic field has been given by Chapman [3]. The coordinates of the zone of reflection, computed for "Roshchino" from conditions of strict perpendicularity of the wave vector of the signal and the vector of field intensity, agree well with experimental data. In reality the process of reflection (scattering) is characterized by some scattering diagram which evidently is quite narrow. The second condition is the result of the fact that the overwhelming majority of such regions is formed in the small range of heights (approximately 10-20 km) at a height of about 110 km [1, 4].

Diurnal Changes in the Distribution of Radio Reflections

The distance of the radio reflections at "Roshchino" changes in the course of the day. Figure 1 shows the diurnal variation (march) of the mean distance for the fall-winter season. The characteristic curves drawn for different months differ somewhat in amplitude, but their phase remains practically constant. Variations in the mean distance have a diurnal amplitude on the order of $\pm$ 100 km; the mean statistical spread of values for distance is about 30 km. The dashed curve in Figure 1 shows the mean daily variation of the H-component of the magnetic field. The close similarity of the two curves is very interesting and forces us to seek a direct relationship between the mean values of distance of reflection and the values for magnetic intensity.

Let's estimate the variations in the field at a height of 110 km. The two above-mentioned properties of the coordinates of the reflecting regions -- the Chapman condition and constancy of height -- are determined by a line in three-dimensional space. In order to segregate out one point, we assume a third condition. We will only examine reflections originating from regions situated on the same magnetic meridian as the point of radar observation. Let the beginning of the system of coordinates coincide with the point of reflection O, as determined above (Figure 2). If r is the radius-vector of the point of observation P, and F is the intensity of the magnetic field in the region of reflection, then $(Fr) = 0$, or

$$Hr_x + Zr_z = 0, \tag{1}$$

where H and r_x -- horizontal components, and Z and r_z -- vertical

components of the vectors F and r. (Inasmuch as the points P and O by definition are situated on the same magnetic meridian, the vectors F and r lie in the vertical plane ZOX passing through the points P and O).

With a change in the field of Δ F the vector r changes correspondingly by Δr; we will then have:

$$(H + \Delta H)(r_x + \Delta r_x) + (z + \Delta Z)(r_z + \Delta r_z) = 0. \qquad (2)$$

But

$$\Delta r_x \approx \Delta r, \quad \Delta r_z \approx 0, \qquad (3)$$

which is the condition of equality of heights of reflecting regions; the curvature of the Earth is not taken into account.

Taking into account (1)-(3), we find

$$\Delta H = - \frac{H\Delta r + \Delta Z \cdot r_z}{r_x + \Delta r}, \qquad (4)$$

or since $\Delta Z \cdot r_z \ll H\Delta r$ at any possible value of ΔZ:

$$\Delta H = - \frac{H\Delta r}{r_x + \Delta r}. \qquad (5)$$

Essentially the equation (5) imposes limitations only on the orthos of the vectors r and H; we can convince ourselves of this by dividing it by $|F|$, and also by dividing the numerator and denominator of its right part by $|r|$. It is most convenient to express the direction cosines of orthos and their increase through the components and increase of the components of the vectors F and r. Substituting in formula (5) r_x = 700 km, Δr = 100 km, in accordance with Figure 1, and assuming H to be equal to the value of the horizontal component at the Earth's surface near the point of reflection (0.12 gauss), we get $|\Delta H|$ = 0.015 gauss.

It is now possible to estimate the height of the currents above the Earth's surface which cause these variations of the field; it can be done with an accuracy which is apparently greater than the accuracy of the method using measurements of magnetic variations at different points on the Earth's surface.

We use the just-derived value of the change of H for the height of auroras, that is, at the height h_1 = 110 km (1500 γ) and the mean value of variation at the Earth's surface at the height h_2 = 0 ($\sim$30 γ). We approximate the value of the horizontal component of the field with a value inversely proportional to the n-th power of the difference in the height of observation and the height h_o creating this field of currents. Then we get

$$((h_o - h_1)/h_o)^n = 30/1500 = 2 \cdot 10^{-2}$$

or

$$\frac{h_o - h_1}{h_o} \approx (2 \cdot 10^{-2})^{1/n} .$$

Since it is clear that $0 < n < 2$, then

$$\left| h_o - h_1 \right| \ll \left| h_o \right| ,$$

the closer is the distribution of currents causing the diurnal variations of the field to the surface, the closer is n to zero and the more intense should this inequality be in order not to disrupt the preceding relationship. The indicated method of estimating the value h_1, to be sure, is not rigid. It nevertheless makes it possible for us to conclude that the height at which it is possible to assume the flow of currents causing the diurnal variations of the magnetic field should be rather close to the height of regions of radio reflection (that is, 110 km).

Comparison of the Characteristic Curves of Radio Reflections and the Magnetic Field During Magnetic Storms Associated With Auroras

We have studied the probability of reception of reflections depending on their corresponding distance and the simultaneous values of the H-components of the magnetic field [5]. The computation was made for distance intervals of 100 km and H-change intervals of approximately 40 γ. The interval of values of ΔH, exceeding 600 γ, was not limited by large ΔH.

The results of our analysis have shown that for any fixed distance in the interval of change of ΔH from + 100 γ to - 500 γ the probability of appearance of a reflection is approximately identical, while the range of distances of reflections is also approximately constant. With an increase by more than 500 γ from the normal value, the probability of radio reflections increases sharply. This increase is accompanied by the appearance of reflections at considerable distances, as much as 1,200 km, that is, to the limit of the possibilities of our equipment. There is a corresponding increase in the range of distances of the observed reflections since there is also an increase in the probability of reception of reflections when the values for distance are small. A typical graph of the dependence of the probability of reflection P on the value of the H-component in the case of such a "sporadic" disturbance of the field during the occurrence of auroras is shown in Figure 3; it is an example of reflections when the values for distance are 700-800 km. An investigation was also made of the change in the mean azimuth of reflection (ε) depending on the value for sporadic disturbance of the H-component of the field (Figure 4). It can be seen

that such a relationship evidently exists but the spread of values of the mean azimuths is very great. It may be assumed that changes of the mean azimuth of arrival of reflections should be associated with changes in declination of the magnetic field. Data now at our command give evidence that in the zone of the station "Roshchino" negative variations of H most commonly coincide with positive variations of declination of the magnetic field; however, the quantitative characteristics of such a coincidence changes considerably for different magnetic bays. The presence of a spread of points in Figure 4 is evidently the result of the facts indicated above.

Conclusions

1. From observations of radio reflections during the time of occurrence of auroras it may be concluded that the magnetic field at a height of about 100 km differs considerably from its dipole component and approaches the value of the field at the Earth's surface.

2. Of the two principal hypotheses explaining the location of the regions of reflection at the time of the occurrence of auroras, the Chapman and Moore hypothesis concerning the dominating role of the condition of perpendicularity of the wave vector to the vector of the Earth's magnetic field appears to be in better agreement with the experimental data collected at the station "Roshchino" than is the Kaiser hypothesis [1] which asserts that zones of reflection are associated with a narrow zone of geomagnetic latitudes. This conclusion is also confirmed by the results of radar observations made in New Zealand [6, 7] and are evidently correct without regard to the point of observation.

3. The diurnal changes in the mean distance of reflection can explain the diurnal variations of the magnetic field and even variations of the H-component alone.

4. In the case of sporadic disturbances the character of the influence of variations of the magnetic field on radio reflections can be explained by the fact that a decrease in the H-component leads to a shifting of the field that is geometrically most favorable for the reception of reflections to zones of large values of anomalous ionization. In an undisturbed field the Chapman condition at distances exceeding 800 km from the station "Roshchino" for the most part corresponds to heights greater than 110 km. But if a decrease in the H-component of the field at the Earth's surface at the time of sporadic disturbances is also accompanied by a decrease at the height of 110 km, there should appear the observed effect of a sharp increase in the probability of reflection with great distances.

Since a decrease in the H-component is most commonly correlated with in declination, the most probable arrival of reflections is from the northeastern, and not from the northwestern part of the zone of reflections; this explains some of its asymmetry.

I am grateful to V. I. Krasovskiy, who inspired the initiation and organization of this work, and to B. A. Bogaryatskiy for much valuable advice.

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("Comparisons of the Parameters of Radio Reflection with Variations of the Magnetic Field During Auroras," by V. I. Pogorelov, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No. 7, 1960, pp 1082-1085)

FIGURE APPENDIX

FIG. 1

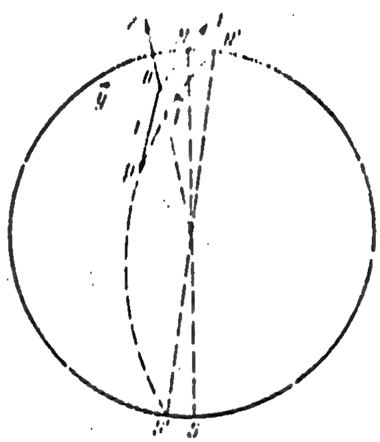

FIG. 2

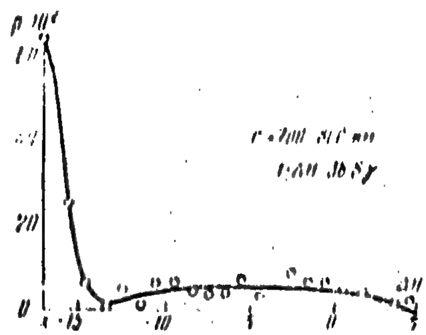

Fig. 3

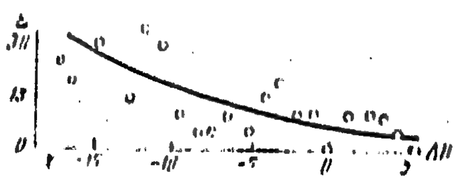

Fig. 4

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A New Photometer

A new design of a differential photometer for a solar magnetograph is described. It differs from the existing types in that one photomultiplier is used instead of two and that there is auxiliary modulation of the light beam by means of an electro-optical crystalline modulator. Analytical expressions describing the process of transformation of the light beam in the instrument are given. ("A New Design of a Differential Photometer for a Solar Magnetograph," by L. M. Kotlyar, Main Astronomical Observatory, Academy of Sciences USSR; Moscow, Astronomicheskiy Zhurnal, Vol 37, No 3, May-June 1960, pp 469-475)

A New Spectrophotometer

A new type of stellar spectrophotometer with integration is described. An interval of the observed spectrum is scanned by moving of the spectrophotometer exit slit. During the motion of the slit from one to the other end of the spectral range, the integrating capacitors are connected one after another with the multiplier by the special electromechanical device. The potentials of the capacitors are averaged by repeated scanning. One scanning time is 25 seconds, the number of scans -- up to 15.

In such a way, the increase in observation time is reached without any loss of accuracy due to the drift and atmospheric transparency variations.

The hydrogen absorption lines records, obtained at different times with 50 cm reflector, show reliability up to one percent for the stars 3^m to 4^m and 1.5 to 2% for the stars 5^m, when the dispersion is 25 Å/mm and observation time is 4 to 8 minutes. ("An Integrating Stellar Spectrophotometer," by N. A. Dimov, Crimean Astrophysical Observatory, Academy of Sciences USSR; Moscow, Astronomicheskiy Zhurnal, Vol 37, No 3, May-June 1960, pp 464-468)

Ionization of Meteor Trails

It is shown that the ionization parameters (i.e., the work function of the electron, positive ion, ionization potential of the atom and the probability of evaporation of a neutral atom) of a meteor body vary as it heats up during its motion in the earth's atmosphere and as its fractions with lowest boiling points evaporate.

The oxides of alkaline and alkaline-earth metals contained in stony and iron-stony meteors provide for the low values of the work function of the electron and positive ion.

As a result of the process of continuous "blowing-off" of particles from the surface of a meteor body by the encountered flow of gas molecules, which excludes the formation of space charges and due to the emission of charged particles of both signs, dynamic equilibrium between

emission intensities of electrons and positive ions sets in. Considerations for the computation of equilibrii values of work function of the electron and positive ion are given.

The noted circumstances give grounds for the reconsideration of existing conceptions on the theory of ionization of meteor trails. ("Theory of Ionization of Meteor Trails. I. The Kinetics of Variations of Ionization Parameters of Meteor Bodies during Their Motion in the Earth's Atmosphere," by A. M. Furman, Moscow, Astronomicheskiy Zhurnal, Vol 37, No 3, May-June 1960, pp 517-525)

Meteor Radio Echo

An approximate expression has been obtained for the duration distribution of meteor radio echoes received from the characteristic height region, in the case of unstable trails.

The character of the distribution of reflections according to durations is determined by the law of distribution of meteor bodies with mass, the velocity of meteoric bodies and the wavelengths of the locator. ("The Duration Distribution of Meteor Radio Echoes. II. Reflection from Unstable Trails," by Ye. I. Fialko, Moscow, Astronomicheskiy Zhurnal, Vol 37, No 3, May-June 1960, pp 526-529)

Solar Corpuscular Emission

A general definition of the source of corpuscles responsible for M-disturbances is given: "almost every active region (including the UM phase), even when there is no chromospheric and radio spot activity in it, is a permanent source of relatively slow particles, moving inside an approximately radial bundle." According to this definition the superposed epoch method should give practically identical curves for plages and bright coronal regions in λ 5303, because in the projection on the disk (near its center) the coordinates of the active region, determined by floccular emission, bright coronal emission in λ 5303 and the local magnetic field, coincide.

The above definition of the source of M-corpuscles should be contrasted to those hypotheses which do not assume the source of M-disturbances to be active regions.

It is shown that the postulated high concentration of corpuscles in interplanetary space ($n_e \approx 10^3$ cm^{-3} at the distance of the Earth from the Sun) is in contradiction with many facts. Additional arguments in favor of this conclusion are given. In particular, the seasonal variations of the normal level of the Earth's magnetic field (between disturbances) at the minimum of solar activity in 1954 were of opposite sign to that which should have been expected, if it is supposed that the corona plays a large role in producing the general corpuscular field of the Sun.

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In conclusion it is indicated that a general corpuscular field from the Sun exists, but with a concentration less by several orders than that mentioned above. The acceleration of gases in cometary tails is produced by magnetic fields frozen in corpuscular condensations. ("The Existence of a General Corpuscular Field From the Sun," by E. R. Mustel, Astronomical Board, Academy of Sciences USSR, Moscow, Astronomicheskiy Zhurnal, Vol 37, No 3, May-June 1960, pp 396-402)

Velocity of Solar Corpuscles

In the present study attention is paid to the important fact that very often (almost as a rule) the time lag Δt of all the members of any one geomagnetic sequence remains approximately constant. Δt is constant notwithstanding the fact that the physical state of the active region producing the geomagnetic sequence can undergo (during the existence of the latter) exceedingly strong variations (from a very bright plage with intense coronal emission in λ 5303 to a unipolar region without flocculur emission and bright emission in λ5303). And in general the time of commencement of a disturbance in a sequence, estimated from the formula $t = t_0 + 27^d XX^n$, is not connected with the intensity variations of the disturbance itself (taking into account the influence of variations of B_0). At the same time the variation of the physical state of the active region should entail considerable variations of the corpuscular velocities v in the stream from one rotation to the next, and thereby lead to very noticeable variations of Δt.

In connection with the above facts it is concluded that each corpuscular stream above an active region is an assembly of relatively stable magnetic tubes of force. This conclusion is in agreement with E. Y. Bugoslavskaya's results, which show that straight intense rays emerge from facular regions.

In the case under consideration the velocity of motion v of gases along the tubes can be much smaller than the velocity, which is obtained on the basis of calculations according to Δt found from connections between plages and disturbances. Approximate computations, show that field strengths of the order of 10^{-4} to 10^{-5} gauss are sufficient to carry away (in connection with solar rotation) all the matter in the tubes. The problem of gas velocities in the tubes is considered and arguments are given in favor that in many cases v can actually be small. The question of the appearance and disappearance of the tubes is also discussed. The tubes are apparently formed at the beginning of the development of the active region. It is pointed out that the absence of stability in coronal tubes from E and F type active regions can in several cases lead to the absence of M-disturbances from these regions.

In the model considered here the main velocity of corpuscles in the stream relative to the earth is the transversal velocity V of the order of 400 km/sec. This can also explain the rectangular character of many M-disturbances. Besides, the position of the vector V can apparently give a more natural explanation of the fact that M-disturbances begin in the second half of the day local time.

In conclusion several arguments are given in favor that the transversal motion of magnetic tubes should not lead to a noticeable transversal motion of gases in the cometary tails. ("The Velocity of Corpuscles in Streams Responsible For M-Disturbances," by E. R. Mustel, Astronomical Board, Academy of Sciences USSR, Moscow, Astronomicheskiy Zhurnal, Vol 37, No 3, May-June 1960, pp 403-409)

Soviet Abstract of Article on Polarization of Solar Emission

On the basis of 12 best spectrograms, a study was made of the difference between the polarization spectrum of a continuous emission produced in active formations on the sun and an instrumental polarization spectrum of the adjoining undisturbed atmosphere. It was discovered that, in 30 percent of the cases, this difference far exceeds the limits of random errors of measurement, thus indicating an occasional polarization of a continuous emission emanating from the center of flares and near the spot being formed. ("On the Polarization of the Continuous Emission in Active Formations on the Sun," by A. B. Severnyy and V. L. Khokhlova, Izv. Krymsk. astrofiz. observ., Vol 20, 1958, pp 67-73; from Referativnyy Zhurnal - Astronomiya-Geodeziya, No 6, 1960, Abstract No. 5224)

III. METEOROLOGY

Abstracts of Articles on Meteorology from the July 1960 Issue of the "Izvestiya" of the Academy of Sciences of the USSR, Geophysical Series

1) "Computation of the Dimensions of Waves Possible During Atlantic Hurricanes" by V. V. Shuleykin, pp 1013-1021.

The author develops a theory of wind waves applicable to computations of waves with increasing wind velocity in the field of an Atlantic hurricane of average intensity. It is shown that at the average force of a hurricane (maximum wind velocity, 60m/sec), the height of the waves can reach 12.5-13 m. The length of the waves in this case is on the order of 230 m.

2) "Computation of the Radiation Cooling of Clouds" by Ye. M. Feygel'son, pp 1030-1041.

This article explains certain problems in a method for computing the radiation cooling of clouds. The author gives examples of computations relating to real atmospheric conditions. The results of computations are compared with data resulting from actual measurements.

3) "Frequency Spectra and Distribution Functions of Probability of the Vertical Component of Wind Velocity" by A. S. Gurvich, pp 1042-1055.

This paper presents the results of measurements of frequency spectra and distribution functions of probability of the vertical component of wind velocity in the near-surface layer of the atmosphere. The processing of measured data on the basis of the theory of similarity has made it possible to determine the universal functions of the spectrum. Using the results of measurements we get an approximate estimate of the coefficient of asymmetry of the distribution function of probability.

4) "Comparative Measurements of Concentration and Distribution Functions of Particles of Aqueous Aerosols" by A. G. Lakhtionov and L. M. Levin, pp 1056-1058.

The principal merit of this illustrated article is its descriptions of instruments designed for use in determining the concentration and distribution function of particles of aqueous aerosols.

5) "Equations for the Crystallization of a Supercooled Cloud with Coagulation Considered" by V. I. Belyayev, pp 1059-1068.

The method of describing the crystallization of supercooled clouds earlier proposed by the author and his colleague A. G. Kolesnikov, is generalized for a case of more complex phenomena occurring during the crystallization of a supercooled spatially homogeneous water cloud. The coagulation of cloud particles and thermal and

electrical processes in the cloud are taken into account. The resulting closed system of equations for description of the process of crystallization in time, based on rather general assumptions relative to the individual processes of which cloud crystallization consists.

6) "Bimetallic Pyrheliometer" by P. A. Krylov, pp 1086-1090.

A newly designed pyrheliometer is described in considerable detail; the characteristics of this bimetallic instrument are listed and a report is given on the performance of the first experimental models. Photographs show the bimetallic element, front, side and rear views of the instrument itself, and the apparatus used for calibration of the instrument.

IV. GEOMAGNETISM

"On the Connection Between Chromospheric Flares and Geomagnetic Activity" -- Full Translation of an Academy of Sciences Paper

In an earlier paper [1] we pointed out the existence of three maxima of geomagnetic disturbances, following the moment of passage of an active region across the Sun's central meridian. That paper also provided a graph showing the mean daily characteristics of the field of telluric currents as received by the method of superimposing epochs in the period July 1957-July 1958. That paper used data pertaining to flares with an intensity of 2 and 3; those data were taken from [2].

In this article we made use of more complete information on flares [2, 3]. We have used all 137 cases of intense flares for the period June 1957-May 1959, without exception; these flares were of intensity 3 and 3+. Flares of a lesser intensity were not taken into account because of their great number. The zero-day selected in this case in the method of superimposition of epochs was the day of passage of the F-region (in which the flare was observed) across the central meridian. The reduction of the F-region to the central meridian is accomplished by using the formula:

$$T_o = t + \frac{27\lambda}{360},$$

where T_o -- the day of passage across the central meridian; t -- the day when the flare was observed; λ -- heliolongitude from the central meridian. For each T_o the planetary mean diurnal K_p-indices were written in a line; these indices correspond to the 34 subsequent and 34 preceding days. In the table thus derived the K_p-indices are averaged out in vertical columns. The results are plotted on a graph in the form of a curve: on the Y-axis -- the averaged values of K_p; on the X-axis -- the time in days, read from T_o.

Figure 1 (bottom) shows a curve of the mean K_p-indices; it was drawn for all 137 cases of flares.

As demonstration of the stability of the discrete maxima we draw curves for flares (of the same 137 mentioned above), observed separately in the northern, southern (Figure 1, top), western and eastern (Figure 2) hemispheres of the Sun. In these graphs the Sun's disk has been symbolized over each curve. In drawing a curve we took flares from the shaded region of the disk; the number above the disk is the number of flares used; r -- the coefficient of correlation of the corresponding curves, computed for days after $T_o (\Delta t \geqslant 0)$.

We can draw the following conclusions from an examination of Figures 1 and 2: a) after the passage of the F-region across the central meridian there is an increase in geomagnetic activity on the

2-3, 11-12, and 22-23rd days; b) the three indicated maxima occur both in the case of flares in the northern and southern hemispheres of the Sun; c) a 27-day recurrence of each of the three maxima is quite clearly observable. The last observation is interesting because on the Chree diagram, drawn for this same interval of time (the zero-days used were those with heightened disturbances, without regard to solar activity); we can see clear increases in activity on the 14th day before and after the zero-day (Figure 3, top). Thus, it may be assumed that the increase in activity on the 14th day on the Chree diagram is the result of a combination of three maxima, alternating on the 8-9, 11-12, 16, and 19th days. The existence of three maxima cannot be explained by the presence on the Sun's surface of stable geoactive, so-called "sick" longitudes. In actuality, the alternation of the 8th and 11th days corresponds to the alternation of active longitudes across 103° and 146°. Since we took into account all intense flares without exception, we must then assume that the flares appear only in the region of the longitude that is 103°-110° distant from adjoining "sick" longitudes. In this case other active longitudes must emit corpuscles without the appearance of flares. Such an assumption is evidently not a very probable one.

Figure 4 shows curves derived by the method of superimposition of epochs during the period June 1957-May 1958 and separately during the period June 1958-May 1959. The number of zero-days for both curves is approximately identical. As can be seen from the graph, the maxima clearly appearing in a year of high solar activity to some degree "dissolve" in a year of decline; nevertheless they remain noticeable. It may be assumed that the probability of appearance of three maxima decreases with a dropoff in solar activity. Unfortunately, the absence of sufficiently complete information on flares during years of low activity do not make it possible to directly establish the presence of discrete maxima in other years of the cycle. However, the presence of three maxima during any year in the preceding 11-year cycle has been established indirectly [1]. If the increase of activity on the 14th day (in the Chree diagram) is due, as was assumed above, to the convergence of the three maxima, then its presence and value on the lower curve (Figure 3) is in complete agreement with the assumptions set forth.

Statistical investigations conducted in this work and in [1] evidently cannot provide an explanation for the appearance of three discrete maxima. However, it may be assumed that solar formations (spots, flocculi and others) emit corpuscles independently with velocities which are different for each individual formation. The effect of the flare is a "bench mark," indicating the position of the active region on the Sun's disk. The different elements of the active regions, interconnected in space, emit corpuscles of different energies (velocities). Mention should be made of the possibility that the velocities of the particles from each formation change with time in the course of the cycle of solar activity (Figure 4). What has been set forth above requires confirmation by additional investigations of the geomagnetic efficiency of the various solar formations.

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1. Barsukov, O. M., On the Problem of Three "Velocities" of Corpuscular Streams, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 1, 1960.

2. Solar Data, Leningrad, 1957-1959.

3. Compilations of Solar-Geophysical Data for the Period 1957-1959 (Summary), Boulder, Colorado (National Bureau of Standards, Central Radio Propagation Laboratory).

("On the Connection Between Chromospheric Flares and Geomagnetic Activity," by O. M. Barsukov, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 7, 1960, pp 977-978)

FIGURE APPENDIX

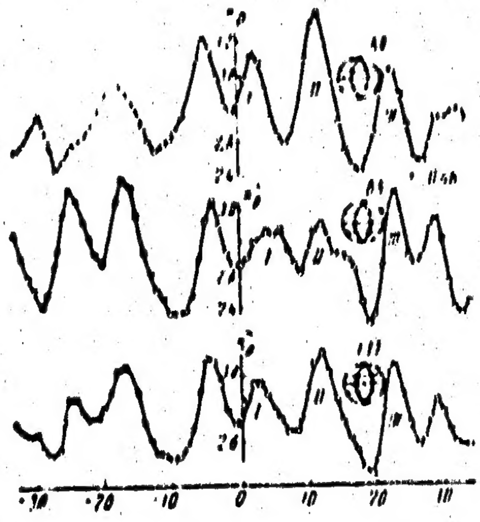

Fig. 1

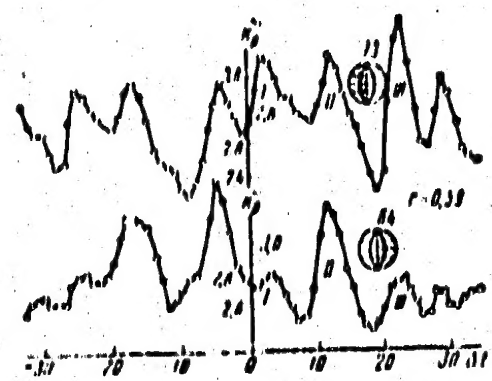

Fig. 2

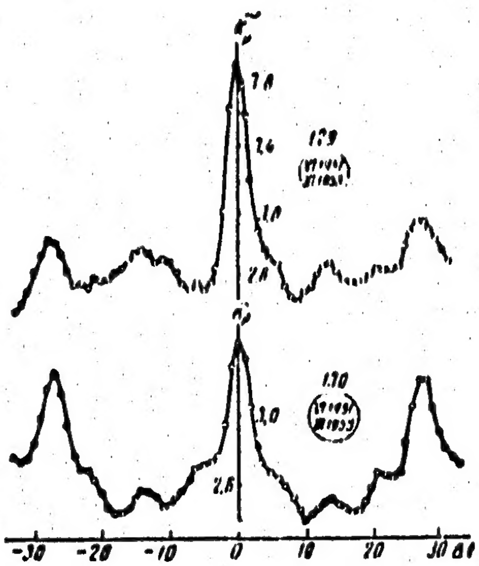

Fig. 3

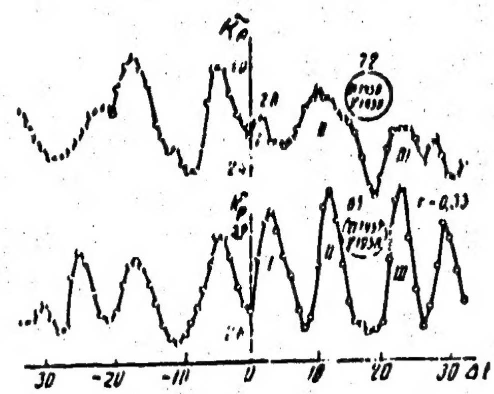

Fig. 4

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V. OCEANOGRAPHY

Report on Lithuanian Scientific Research Vessel

The following is a translation of a caption for a photo recently appearing in the newspaper Ekonomicheskaya Gazeta:

The "Neringa," research vessel of the Administration of the Hydrometeorological Service of the Lithuanian SSR, has left the port of Klaypeda in the Baltic on its sixth voyage of the year. The oceanographers shown are studying the hydrometeorological regime at sea. They are investigating the temperature of the water and currents at various depths, wind direction and velocity, and atmospheric pressure.

The photo shows senior oceanographer-technologist K. Shukis (at left) and the chief of the expedition's research program, L. Yatskunas. (Uncaptioned photograph, Ekonomicheskaya Gazeta, 20 August 1960, p 3)

The "Shokal'skiy" Drops Anchor at Vladivostok

The following is the full text of a brief news report published in the Soviet press:

Yesterday the scientific research vessel "Yu. M. Shokal'skiy" of the Hydrometeorological Service of the USSR dropped anchor in the Golden Horn. It has been 50 days out of Odessa on its first voyage. It has travelled on two oceans and eleven seas and has crossed the Equator four times.

During the voyage scientific investigations were made of the sea bottom, jointly with studies of the atmosphere -- from the lowest layers adjoining the ocean to the upper layers of the stratosphere.

After a stay in Vladivostok the "Yu. M. Shokal'skiy" will conduct research in the Pacific Ocean. ("At Anchor in the Golden Horn," Ekonomicheskaya Gazeta, 21 August 1960, p 4)

Two Papers of Interest to Oceanographers Published in Recently Received Soviet Geophysical Publication

1. B. A. Tareyev of the Institute of Oceanology of the Academy of Sciences of the USSR is the author of an 8-page article in a recently received publication of the Academy. His article examines the possibility of the development of cellular circulation in deep oceanic depressions with due regard for the rotation of the Earth. He investigates cases in the high and low latitudes and establishes critical parameters for convection. The results of his theory are confirmed by certain observational data. ("On the Theory of Convectional Circulation in Deep-Water Depressions of the Ocean," by B. A. Tareyev, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 7, 1960, pp 1022-1029)

2. A. D. Yampol'skiy, another worker at the Institute of Oceanology, is the author of a brief communication concerning the use of harmonic analysis for the processing of hydrological data. ("On the Use of Harmonic Analysis for the Processing of Data Resulting from Hydrological Observations," by A. D. Yampol'skiy, Izvestiya Akademii Nauk SSSR, No 7, 1960, pp 1069-1071)

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